Chapter 2
Automotive Recycling Industry

Introduction

The automobile industry is the largest manufacturing industry in the world, and as expected, the industry connected to the recycling of those automobiles is equally large. Every year over 11 million vehicles are recycled. These recycled cars and trucks produce almost 40 percent of the ferrous scrap for the scrap metal processing industry. (1)

This chapter provides a brief overview of the automotive recycling industry, a process description of a typical automotive recycling facility, a description of the possible contaminants located at an automotive recycling brownfield, and information on possible methods of remediation.

Automotive Recycling Industry Overview

Automotive recycling employs more than 40,000 people in the United States, and there are an estimated 7,000 vehicle recycling operations in place around the country. (2) The industry is a major source of scrap metal for the steel industry. This scrap metal is much cheaper than raw ore and, as an added benefit, EPA estimates that steel mills which substitute low-sulfur scrap metal for high-sulfur raw ore can reduce their air pollution potential up to 86 percent and water pollution potential by up to 76 percent. (1)

Automotive recycling facilities can vary in size from a small warehouse to a major manufacturing facility. Some operations are vertically integrated, meaning that more than one step takes place in one location. These facilities tend to have more environmental issues because a wide range of activities take place on-site. Many automotive recycling facilities specialize in one activity, such as dismantling. This reduces the compliance burden by allowing the operator to concentrate on one activity and the characteristic waste stream of that activity. When deciding if and how to remediate an automotive recycling brownfield, the specific nature of the operation that was located on-site should be investigated to better characterize the pollution potential of that facility.

Common Activities at an Automotive Recycling Facility

There are a number of unique activities that take place in the automotive recycling process. Some facilities participate only in one step in this process, while at others, multiple activities take place on-site.

Storage

Before being recycled, most cars and trucks are stored for some period of time in a salvage yard. Vehicles-in-storage give the automobile recycling facility its junkyard image. Vehicles can be stored under cover or in open yards exposed to the elements. Storage yards can range in size from a few thousand square feet to 30 acres or more. When evaluating the pollution potential of a storage yard, the following characteristics should be evaluated: substrate (i.e., surface vehicles are stored on: concrete, dirt, grass, etc.), vehicle exposure to elements; permeability of the soil; and stormwater removal system. Also, investigators should determine if other activities (such as dismantling or fluid drainage) occur in the storage yard.

Dismantling

Dismantling design and operations can vary from one facility to another. In general, vehicle dismantling involves the following steps :

Fluid Draining - In this step, all fluids are drained from the vehicle including oil, antifreeze, coolant, brake fluid, transmission fluid, and washer fluid. At larger sites of this type, consideration could be made of the use of distillation to extract oil and grease, glycolates, acetates, and formates. Arsenic above regulatory limits remains in the sludge, necessitating hazardous waste treatment.

Parts Removal - In this step, easily removable parts of the vehicle, both interior and exterior, are stripped. The purpose of this step is to remove as many parts as possible so that only the frame remains. This includes removing all seats, dashboard, carpeting, and windows. The parts are then, depending on their condition and market value, resold, recycled, or disposed in a landfill. Many of the removed parts are plastic which can now be recycled.

Powertrain Removal - This step consists of the removal of the engine, transmission, and axles. It is the final step before the vehicle is sent to the shredder.

Crushing Some recyclers do not have shredding capability, crush cars before they are transported to a metal recycler, who will shred the material. Crushers should be used on an impervious, fluid controlled surface, though this is not always true. Sites without such surfaces may contain contamination by fluids, or these fluids may have escaped to drain systems, or have been lost onto the ground. On older sites, non-metallic materials, known as "fluff" may have been buried on site. This may also be true of battery casings, tires, and other unmarketable materials. This situation might leave the site with PCB contamination from transformers.

Shredding

The final step in automotive recycling is the shredder. It is here that the real economic benefit of automobile recycling is realized. The vehicle, drained of all fluids and stripped of as many parts as possible, is compacted and then sent through a shredder where the ferrous materials are separated from the non-ferrous materials then shredded. The shredded ferrous material is sold to a steel mill where it is incorporated into new steel products. The non-ferrous material, or Automobile Shredder Residue (ASR), is disposed in a landfill. ASR consists of a mix of plastics, fluids, and other metals and can pose a disposal problem. ASR can sometimes make up as much as 25 percent of the total weight of the car. (1)

Possible Contamination

There are many possible contaminants that could be located at an automotive recycling facility brownfield. Each step in the process generates waste streams which can impact soil and water in and around the vicinity of the recycling operation.

Soil Contaminants

Common soil contaminants at an automotive recycling facility include petroleum hydrocarbons; oil and grease; volatile organic compounds (VOCs); and semivolatile organic compounds (SVOCs) from gasoline, motor oil, antifreeze, and transmission fluids. There can also be soil contamination from such metals as aluminum, cadmium, chromium, lead, and mercury. Cars older than 1993 may contain chlorofluorocarbons (CFCs) in the air conditioning system. Older cars may also contain asbestos in brake shoes.

The soil at an automotive recycling operation can be contaminated in a number of ways. If storage is in an open field, fluids can leak onto the ground and rainwater can wash contaminants off the vehicles. Dismantling usually takes place on a concrete pad; however, some facilities use a gravel-surfaced area. Soils underneath an unprotected gravel area are likely to be contaminated. If the concrete pad is cracked, spills can penetrate the openings and contaminate the soil. The shredder can also release metal shavings and other contaminants into the surrounding soil. Contaminated soils may have to be collected from a variety of spots on the site, for classification and disposal or treatment.

Auto recycling facilities were often used as general scrap metal sites,

Water Contaminants

Generally, the same contaminants that affect soil also have the potential to affect ground and surface waters in and around vehicle recycling facilities. More specifically, organics (from gasoline, motor oil, and other fluid leakage) can easily form subsurface reservoirs that can adversely affect water quality for years after a site

has been closed. In addition, heavy metals can contaminate the groundwater.

Typical Remediation Strategies

There are two media which any remediation program must address: the soil and the water. Each media can be contaminated by the same chemicals, but the ways that developers and managers reduce or eliminate contamination in these media can vary.

Soil Remediation

Soils contaminated by heavy metals at automotive recycling facilities are a significant concern. Many times these soils must be excavated and shipped off-site for disposal in a hazardous waste landfill. Soils contaminated with heavy metals can also be treated by stabilization/solidification techniques which is described in the following paragraph.

Solidification/Stabilization - Solidification/Stabilization (S/S) reduces the mobility of hazardous materials through chemical and physical means. S/S technologies can immobilize many heavy metals, certain radionuclides, and selected organic compounds, while decreasing the surface area and permeability of many types of sludge, contaminated soils, and solid wastes.

Other contaminants that are typically found in the soil, such as VOCs and SVOCs, can be treated effectively with more conventional soil treatment techniques. Some of these techniques include:

Bioremediation - Bioremediation refers to treatment processes that use microorganisms (usually naturally occurring) such as bacteria or fungi to break down hazardous substances into less toxic or nontoxic substances.

Soil Flushing - In soil flushing, contaminants in the soil are extracted with water or other aqueous solutions. The extraction fluid is passed through in-place soils using injection or infiltration processes. Extraction fluids must be recovered with extraction wells from the underlying aquifer and recycled or treated when possible.

Chemical Oxidation - Chemical oxidation processes convert hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, or inert. These reactions involve the transfer of electrons from one compound to another. The oxidizing agents commonly used are ozone, hydrogen peroxide, hypochlorite, chlorine, and chlorine dioxide.

Surface and Groundwater Remediation

Both surface and groundwater can be contaminated with chemicals from vehicle recycling facilities. In general, surface water contamination tends to be short term, especially if the contaminated body of water is a river. Only in rare instances will significant treatment programs be necessary to deal with surface water contamination, and for that reason, this document will not address such programs. On the other hand, groundwater contamination is a very long term problem, where contamination can persist in aquifers for years without treatment. In addition, groundwater is the source of significant amounts of our drinking water, especially in rural areas where it is widely used in homes with wells.

Treatment Walls - A treatment wall is permeable reaction wall installed inground, across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. The wall can be made from a variety of different materials, depending on the contaminants that are present. The walls are constructed such that water can flow through, while contaminants bond with chemicals in the wall. Contaminants are typically completely degraded by the treatment wall.

Groundwater Extraction/Injection - This groundwater treatment technique requires the drilling of treatment wells into the contaminated aquifer. These wells are then used either as injection or extraction wells. Contaminated water is drawn from the aquifer in the extraction well.

Water from an injection well, from uncontaminated region of the aquifer is injected into the contaminated region of the aquifer. This treatment, generally referred to as a pump and treat system, typically takes years to effectively treat contamination, as withdrawal and injection rates must be low to avoid surface subsidence. The alternative is to use the well as an extraction well, where contaminated water is drawn from the aquifer and treated on the surface. In most remediation situations, both of these techniques are used in tandem. Contaminated groundwater is removed from the aquifer, treated, and then returned via an injection well. These treatment techniques typically take years to effectively treat contamination, as withdrawal and injection rates must be low to avoid surface subsidence.

Conclusions

Contamination at vehicle recycling facilities can pose a very real danger to human and environmental health. The contaminants released span the full spectrum of toxicity and remediation of sites contaminated by these chemicals can be costly and time consuming. The contaminants and remediation techniques listed in this chapter are ones typically used at vehicle recycling brownfields, yet every site is unique, and developers will need to develop a remediation plan based upon the contamination actually present on-site.

References

(1) *Automobile Recycling Alternatives: Why Not? A Look at Greener Car Recycling.* Neighborhood Planning for Community Revitalization. 1997. www.npcr.org/reports/npcr1057/npcr1057.html

(2) *About Automotive Recycling.* Automotive Recyclers Association of New York. 2000. www.arany.com/AboutAutomotiveRecycling.htm